Ocean Currents Key

*** For ease of use during class, the teacher key pages are numbered the same as the student book pages ***

I. Introduction

Ocean currents influence the weather in coastal areas. They also influence sailing vessels. Though they visibly affect many people's lives, they are invisible. To be able to map and predict currents, we have to release floating buoys and keep track of their positions.

This activity will introduce you to the information that these buoys collect for us.

Get Info Objectives

1. Relate direction given in degrees to compass direction.
2. Describe floats used in ocean current research.
3. Estimate current speed from scaled graphical representations.

Gather Data Objectives

1. Interpret graphs of current speed and direction.
2. Determine the relationship between current speed and depth.
3. Explain how Global Positioning System equipped drifters send more useful information than buoys without GPS.

Applying Principles Objectives

1. Describe currents' effects on coastal weather.
2. Describe currents' effects on sailing vessels.
3. Describe currents' effects on sea life.

II. Get Info

A. Current Following Floats

- Click on the Langrarian Drifter Float site.

1. What five sensors are attached to a Langrarian drifter?

barometer, submergence sensor, irradiance meter, sea surface temperature recorder, conductivity sensor

2. What do the sensors measure?

barometers measure atmospheric pressure, submergence sensors indicate if the buoy is under water, irradiance measures sunlight intensity, sea surface temperature recorders measure the water temperature, conductivity sensors measure the salinity of the water

- Click "Back" until you get back to the OAR Ocean Currents Get Info site.

B. Interpreting Graphical Current Marks

- Click on the Average Atlantic Current Velocity site.

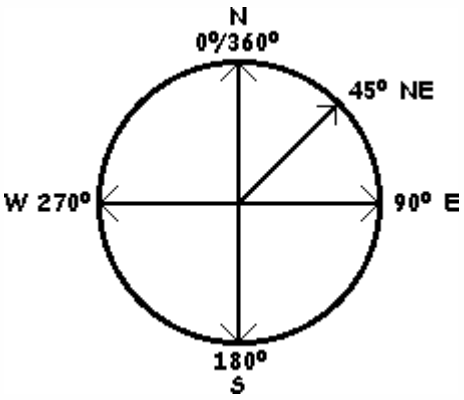
1. At what latitude range is the current strongest? 40 N to 50 N

2. Use the legend at the top of the graph and a metric ruler to measure the strongest current. About how fast is the current?

30 centimeters/second

- Click "Back" until you get back to the OAR Ocean Currents Get Info site.

C. Numerical compass directions



Ocean current information is given as current speed and current direction. The direction is not shown as north, south, east or west. It is given as a number. A circle has 360 degrees. Refer to the picture below to understand how the numbers relate to compass directions. A compass direction of north is given as 0 degrees. A current from the east is given as 90 degrees. A current from the south is given as 180 degrees. A current from the west is given as 270 degrees. Northeast would be 45 degrees.

- Click "Back" until you get back to the OAR Ocean Currents main screen.

III. Gather Data

A. Current Speed and Direction vs. Depth

- Click on the "Brazil" site. (This is the area of the Atlantic Ocean on which you will be gathering data.)

- Click "Back" until you get back to the OAR "Ocean Currents" Gather Data site.

- Click on the "WOCE 1" site.

1. Fill in the missing information in Chart 1 below.

- Click "Back" until you get back to the OAR Ocean Currents Gather Data site.
- Click on the "WOCE 2" site.

2. Fill in the missing information in Chart 1 below.
- Click "Back" until you get back to the OAR Ocean Currents Gather Data site.
- Click on the "WOCE 3" site.

3. Fill in the missing information in Chart 1 below.
- Click "Back" until you get back to the OAR Ocean Currents Gather Data site.
- Click on the "WOCE 4" site.

4. Fill in the missing information in Chart 1 below.
- Click "Back" until you get back to the OAR Ocean Currents Gather Data site.
- Click on the "WOCE 5" site.

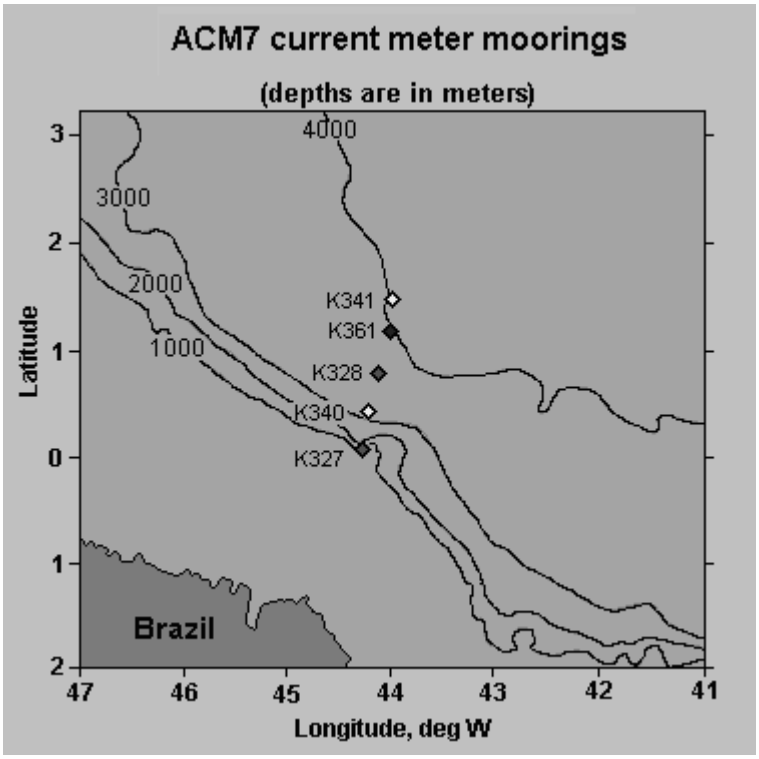
5. Fill in the missing information in Chart 1 below.

Chart 1

Mooring Name	K327	K340	K328	K361	K341
Depth of Current Meter	100 m	50 m	72 m	50 m	50 m
Sea Floor Depth	545 m	3340m	3989 m	4110m	4108 m
Mean (average) Current Speed	103 cm/ sec	92	66	47	38.5
Mean Degrees of Current Direction	312	306	338	290	235
Mean Compass Current Direction of current N, S, E, W	NW	NW	NNW	WNW	SW
Latitude/Longitude	..087 N 44.39 W	.420 N 44.25 W	.833 N 44.07 W	1.186 N 44.04 W	1.55 N 44.01 W

- Use Chart 1 above and the map of the Brazilian coast below to help you do the following activities.

6. On the map below, draw arrows showing the direction of the current. The arrow heads should point in the direction the current flows <u>from</u> the station.



7. What is the relationship between seafloor depth and current speed?

<u>The greater the depth, the slower the current.</u>

8. Does the current seem to flow only along the shore, out to sea, or into the shore? <u>along the shore</u>

- Click "Back" until you get back to the OAR "Ocean Currents" Gather Data site.

B. Open Ocean Current Speed and Direction at 45 meters

- Click on the "Tropical Atmosphere Ocean Array 45 Meter" site.

- Look at the top graph.

1. What month has the greatest current speed? (Current speeds are shown as centimeters per second on the vertical scale.) May

2. What season shows the greatest current speed? Summer

- Look at the bottom graph.

3. What season shows the least variation (change) in direction of current flow? Summer

4. What is the compass direction of flow during this season? East

5. Write the average current speed in June at 45 meters in Chart 2 below.

- Write the number that best fits the graph during June. The graph will not be a straight line, so use a best estimate of the average directions and speeds.

6. Write the average current direction in June at 45 meters in Chart 2 below.

- Click "Back" to get back to the OAR Ocean Currents site.

Chart 2

Depth	Average June Current Speed	Average June Current Direction	
		degrees	compass
45 m	75 cm/sec	100	east
160 m	20 cm/sec	150	SSE
250 m	25 cm/sec	200	SSW

C. Open Ocean Current Speed and Direction at 160 meters

- Click on the "Tropical Atmosphere Ocean Array 160 Meter" site.

- Look at the top graph.

1. Write the average current speed in June at 160 meters in Chart 2 above.

- Look at the bottom graph.

2. Write the direction of current flow in June at 160 meters in Chart 2 above.

- Click "Back" to get back to the OAR Ocean Currents site.

D. Open Ocean Current Speed and Direction at 250 meters

- Click on the "Tropical Atmosphere Ocean Array 250 Meter" site.

- Look at the top graph.

1. Write the average current speed in June at 250 meters in Chart 2 above.

- Look at the top graph.

2. Write the direction of current flow in June at 250 meters in Chart 2 above.

E. Interpreting Data in Chart 2

1. Is there a relationship between depth and current speed? If so, what is it?

Faster currents are towards the top of the water.

2. Is there a relationship between depth and current direction? If so, what is it?

As you go deeper, the current shifts more to the south and west

- Click "Back" until you get back to the OAR Ocean Currents Gather Data site.

F. GPS Upgraded Drifters

- Click on the "Global Positioning Satellite Tracking" site.

- Scroll down to the second picture.

- Read the paragraph between the second and third pictures.

1. What advantage is there to running the drifter's transmitter more often?

A cold current would cool the air near the shore, and a hot current would warm the air near the shore.

- Click "Back" until you get back to the OAR Ocean Currents main screen.
- Click "Application".

IV. Application

A. Ocean Currents' Effects

1. How do you think the temperature of an ocean current could affect weather on the coast?

~~A cold current would cool the air near the shore, and a hot current would warm the air near the shore.~~

2. How do ocean currents affect sailing ships?

~~Sailing ships can use ocean currents to help them move. This is particularly useful when there is no wind.~~

B. Ocean Currents and Marine Life

1. How could ocean currents affect microscopic marine life?

On one hand, cold currents cool organisms and make them slow down. On the other hand, cold currents from the floor of the ocean bring nutrients to the surface so phytoplankton (microscopic plants) can grow and become food for animals.

2. How could ocean currents affect large marine creatures such as whales?

If whales have to go against the current, they use more energy than they would going in the direction of the current. Whales are large, so they have to use a great deal of energy to stay afloat.

- Click "Back" until you get back to the OAR Ocean Currents Application site.
- Click "Enrichment".

V. Enrichment Activities

1. Research "density currents". Relate density currents to "upwelling".
2. Find out how upwelling is related to El Nino.
3. Research the different types of sailing vessels used by traders in the 1500's through the 1900's. How did the materials used to build the vessels change? How did the sails change? How did the navigation change?
4. Research "doldrums" and "horse latitudes." Why were these areas named this way?

B. Related Web Sites

1. Tropical Atmosphere Ocean Array
   http://www.pmel.noaa.gov/tao/select/timeselect.html
2. World Ocean Current Experiment site.
   http://kepler.oce.orst.edu/cmdac/woce_experiments/acm7/acm7_1/mta01589.htm
3. Average Atlantic Current Velocity site.
   http://www.aoml.noaa.gov/phod/graphics/atlanticvel.gif
4. Langrarian Drifter Float site.
   http://www.aoml.noaa.gov/phod/graphics/drifterfig.gif